BIOSYSTEMATIC OBSERVATIONS ON APHRAGMIA INUNDATA (ACANTHACEAE) FROM MEXICO[1]

ROBERT W. LONG

The genus *Ruellia* L. (*sensu lato*) is a large group of plants that is poorly understood taxonomically, especially in the tropics, and until recently there have been few opportunities to compare the better-known North American species with those of Mexico and the American tropics. Acquisition of materials was begun a number of years ago in preparation for selected biosystematic investigations of certain wide-ranging tropical species and their relationship to North American taxa. It is now possible to begin re-evaluation of the taxonomy of some of these species.

Field and garden studies of *Aphragmia inundata* (H.B.K.) Bremek. (*Ruellia inundata* H.B.K.) were initiated in 1970. This species occurs from Mexico south into Colombia and Brazil. Plants are quite abundant locally and may form dense thickets of low shrubs. Mass collections were made in Veracruz and Yucatan, and herbarium specimens from throughout the range were examined. Transplants were grown in the experimental garden and greenhouse, cytological studies were made, and crossing experiments were performed using a number of *Ruellia* species.

MORPHOLOGICAL COMPARISONS

In nature, *Aphragmia inundata* is a ruderal subshrub found in a wide variety of habitats. Plants grow along roadsides, on open slopes or in fields, in dry or moist situations. Characteristically, the plants have woody, whitish, glabrate stems, and their grayish-puberulent leaves emit a pungent odor that has been described as goat-like. Large

[1]Contribution No. 70 from the Botanical Laboratories, University of South Florida, Tampa, Florida. Aided by a grant from the National Science Foundation GB-35231.

Figure 1. Photograph of an herbarium specimen of *Aphragmia inundata* from the Yucatan, Mexico.

numbers of flowers are produced in rather dense subcylindric cymes. Descriptions of the flower (Standley, 1930, p. 424; Leonard, 1936, p. 208; 1951, p. 77) say the corolla is light blue, but in nature and in garden culture it is, in fact, reddish or pink. Other distinctive features of the species are the swollen nodes, the glandular pubescence of the leaves, upper stem, and inflorescence, and woody, rhizomatous underground parts (see Fig. 1).

For purposes of comparison, the important morphological characteristics of *Aphragmia inundata* are contrasted with those of the wide-spread eastern North American species, *Ruellia caroliniensis* (J. F. Gmel.) Steud. and the tropical species *R. tuberosa* L. which is also the type for the genus (Table 1). These taxa of *Ruellia* were chosen for comparison because they are representative of a large section of the genus closely allied to *Aphragmia inundata* (Long, 1975). The principal differences of *A. inundata* from the other two taxa are evident in the structure of the underground parts, the morphology of the stem, the type of inflorescence, the color and morphology of the corolla, the size of the capsule, and the number of seeds per fruit. *Aphragmia inundata* is quite distinct from the other two species.

BIOSYSTEMATIC INVESTIGATIONS

The chromosome number of *Aphragmia inundata* was determined by the aceto-carmine squash method and was found to be $n = 17$ (Fig. 2). This number is identical to all counts reported for species of *Ruellia* (Grant, 1955, Long, 1963). Meiosis was normal with the formation of seventeen bivalents, normal disjunction, and the formation of abundant, fertile pollen.

Genetic testing was carried out using greenhouse-grown plants in controlled experiments. It was not possible to attempt hybridization with many *Ruellia* taxa because of differences in flowering-time, but crosses were attempted with *R. caroliniensis*, and two tropical red-flowered species, *R. macrophylla* Vahl and *R. coccinea* Vahl. Crossing failed

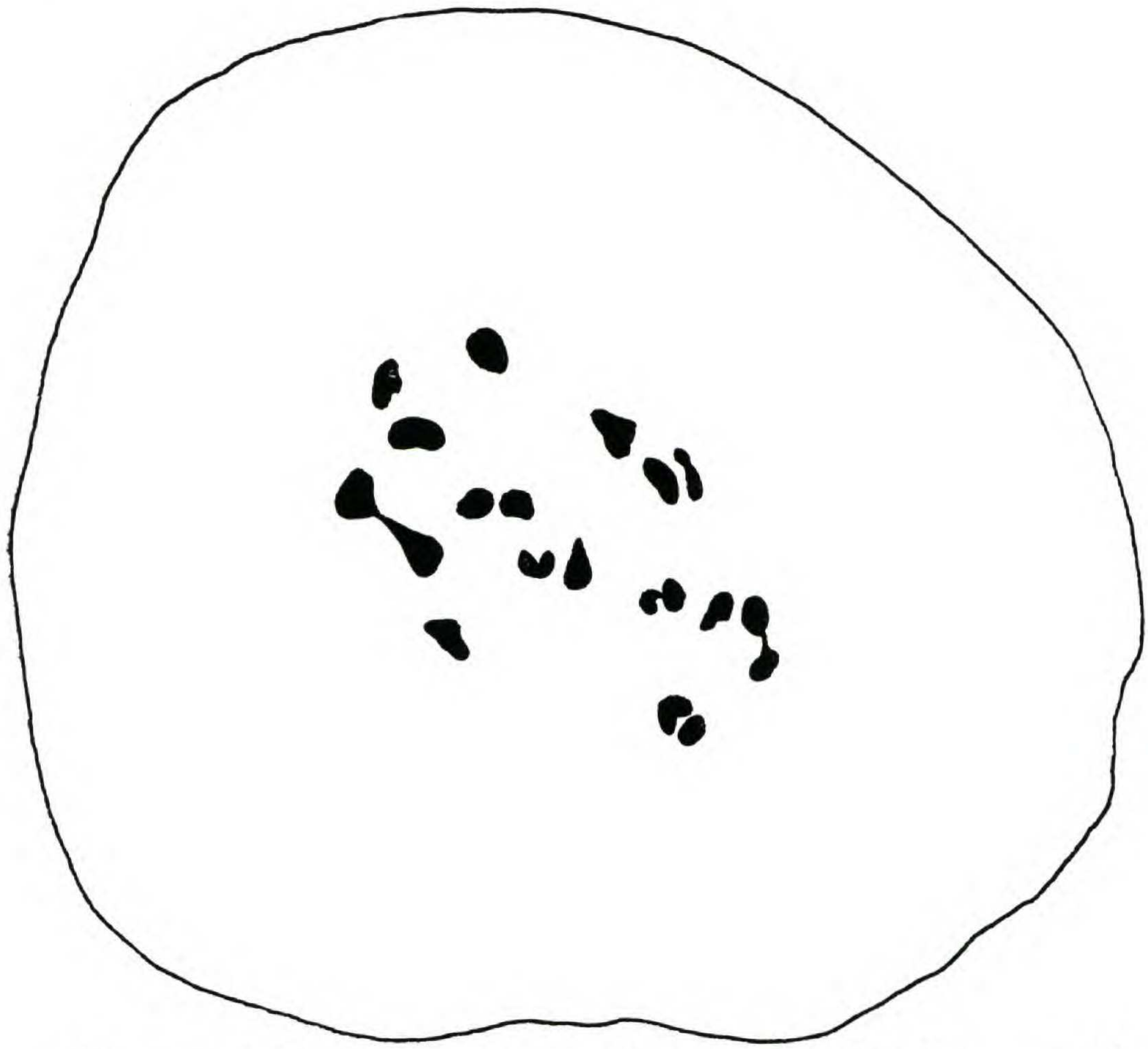

Figure 2. Meiotic chromosomes of *Aphragmia inundata*, $n = 17$, diakinesis, $\times$ 2260 approx.

in all cases after repeated attempts and thus far *A. inundata* appears to be genetically isolated from *Ruellia* taxa (Long, 1975).

There is remarkably little variation in natural populations of *Aphragmia,* with small differences between individuals. Observations on garden-grown plants showed that flowers are generally self-pollinated. The unequi-branched stigma is covered with pollen prior to anthesis. Seed set is abundant and the seeds are viable.

DISCUSSION

Bremekamp and Nannenga-Bremekamp (1948) revised the circumscription of *Ruellia* restricting the genus to five

tropical and temperate American species based on *R. tuberosa* L. as the type, and including *R. intermedia* Leonard, *R. nudiflora* (Englemann and Gray) Urban, *R. lorentziana* Griseb. and *R. malacosperma* Greenm. Bremekamp has proposed the resurrection of a number of segregate genera that were not recognized by Bentham and Hooker (1876) in their concept of the genus. He reestablished *Aphragmia* Nees (1836) based on *Ruellia inundata* H.B.K., and suggested that *Aphragmia* may include other American taxa although he made no specific recommendations. Biosystematic investigations thus far would tend to support the recognition of *Aphragmia inundata,* separating it from *Ruellia* on the basis of both morphological and genetic differences. Although *A. inundata* has the same chromosome number as species of *Ruellia,* it appears to have no close genetic relationship to *R. caroliniensis* or other species with which hybridization has been attempted. Since many *Ruellia* taxa can be successfully hybridized (Long, 1966, 1975), the fact that *A. inundata* is intersterile with species of *Ruellia* tends to support Bremekamp's separation of *A. inundata* in a different genus. Elsewhere I have discussed the necessity of revising the generic concept of *Ruellia* (Long, 1973) in the light of biosystematic research. Although Bremekamp is correct in emphasizing the unnaturalness of *Ruellia sensu lato,* his concept of *Ruellia sensu strictu* is too narrow. A number of his segregate genera, such as *Dipteracanthus* Nees and *Ulleria* Bremek. are not genetically distinct from *Ruellia,* and do not merit generic recognition (Long, 1975). The totality of evidence regarding *Aphragmia inundata,* however, based on both genetic and morphological comparisons, does support the separation of this taxon from *Ruellia.*

The taxonomy of the species is:

Aphragmia Nees in Lindl., Introd. Nat. Syst. Bot. ed. 2, p. 444, 1836, *nomen; id.* in Endl. Gen. Pl. p. 699, 1839. *emend.* Bremekamp and Nannenga-Bremekamp, Verh. Nederl. Akad. Wet. **2.** 45:10. 1948.

A. inundata (H.B.K.) Brem. Verh. Nederl. Akad. Wet. **2.** 45:10. 1948. (type species)
Ruellia inundata H.B.K. Nov. Gen. et Sp. II, p. 239, 1817.
Ruellia albicaulis Bertero ex Spreng. Syst. II, p. 822, 1825.
Dipteracanthus haenkei (Nees) Nees in DC, Prodr. XI, p. 141, 1847.
Ruellia paniculata Millsp. Field Mus. Bull. **1**:46. 1895; 2:100, 1900, *non* L.

Table 1. Morphological comparison between *Aphragmia inundata* and two species of *Ruellia*

	A. inundata	*R. caroliniensis*	*R. tuberosa*
root	knotty rhizome	fibrous, wiry roots	thickened, fusiform roots
stem	suffrutescent, simple or branched; lower stems white, glabrate, upper glandular-pilose; nodes swollen.	herbaceous, simple or divergently branching; glabrous or hirsute; nodes not swollen	herbaceous, branching; stem somewhat quadrangular, pilose or glabrate; nodes not swollen.
leaf blade	lanceolate to ovate; glandular-hispidulous	obovate, lanceolate, ovate or elliptic; hirsute to glabrate	ovate to oblong, abruptly narrowed to base; glabrous
inflorescence	dichotomously branching, in dense cylindric panicle, glandular pubescent	few-flowered glomerules, subsessile, crowded or one to few per axil.	one to several in a dichotomous cyme.
flower	corolla reddish, puberulent, tubular, 2-2.5 cm long; lobes rounded	corolla blue, lavender, or purplish, 2-5 cm long campanulate; lobes suborbicular	corolla blue, lavender, or purplish, campanulate; lobes suborbicular
fruit	glabrous; capsule 8-9 mm long, 2-4 seeded	densely pilose to glabrate; capsule 1.0-1.5 cm long, 8-seeded	glabrous; capsule 1.8-3.0 cm long, up to 40-seeded

REFERENCES

BENTHAM, G. & J. D. HOOKER. 1876. Acanthaceae. Gen. Pl. **2:** 1060-1122.

BREMEKAMP, C. E. B. & N. E. NANNENGA-BREMEKAMP. 1948. A preliminary survey of the Ruelliinae (Acanthaceae) of the Malay Archipelago and New Guinea. Verh. Nederl. Akad. Wet. 2. **45:** 1-39.

GRANT, W. F. 1955. A cytogenetic study in the Acanthaceae. Brittonia 8: 121-149.

LEONARD, E. C. 1936. Botany of the Maya area. Miscellaneous Papers X. The Acanthaceae of the Yucatan Peninsula. Carnegie Inst. Publ. 461: 191-238.

———. 1951. The Acanthaceae of Colombia. I. Contr. U. S. Natl. Herb. **31:** 1-117.

LONG, R. W. 1963. Mass Collections of *Ruellia* in Florida. Yearbook Amer. Phil. Soc. for 1963. pp. 338-341.

———. 1966. Artificial interspecific hybridization in *Ruellia* (Acanthaceae) Amer. Jor. Bot. **53:** 917-927.

———. 1973. A biosystematic approach to generic delimitation in *Ruellia* (Acanthaceae). Taxon **22:** 543-555.

———. 1975. Artificial interspecific hydridization in temperate and tropical species of *Ruellia* (Acanthaceae). Brittonia **27:** 289-296.

STANDLEY, P. C. 1930. Flora of Yucatan. Field Museum Natural History, Botanical Series, **3:** 157-492.

DEPARTMENT OF BIOLOGY
UNIVERSITY OF SOUTH FLORIDA
TAMPA, FLORIDA